It was His will that this ocean of air should constantly flow round and about, and cover our globe; that above this ocean, called the atmosphere, there should be a still clearer and purer matter, commonly called ether, but of whose substance we know nothing; and that above this ocean of ether, destined, like the water and air, to remain in the space assigned to it by God, there should appear the bright moon in her glory, surrounded, perhaps, by an ocean of still purer matter than ether itself, or even, like a ship on the sea, enveloped above in a matter quite different from that in which she is moving below.

Be this as it may, whether two, three, or four oceans or rings of different matter, separate us from the moon; whether she accompanies our earth in her path through the heavens by the reputed law of gravitation, or by some other law we are ignorant of,—this I know, that she does so by the will of God. He has placed her on the ocean of ether that surrounds our atmosphere, like a well-laden ship on the sea: on this ocean she performs her journey round our globe according to laws which God has not allowed us as yet to find out, always presenting to us part or the whole of her hull, without our ever, like a fish in the water, beholding the deck or the masts.

From the coincidence of the exact time of the tides with the exact time of the progress of the moon round the earth, in connection with the rotation of the earth round its own axis, there can be no question but that they are occasioned by the moon, contrary to the idea of Mr. Kerigan, who believes her influence to be entirely negative. Now if we substitute "pressure" of the moon for "attraction" we shall be able easily to point it out as the cause of high and low water.

It seems natural that, like a ship on the sea or a boat on a canal, the passage of the moon over the ocean of ether should produce a pressure below, and a corresponding expansion at the sides: this pressure upon the ether acts upon the air, as the pressure of the air acts upon the water, and the nearer the moon the stronger the pressure, and the further away the less it will be, like the pressure of a ship according to the width of the channel, and the distance from, or nearness of, the shore.

We all know the corresponding effect of the wind, or of an agitated atmosphere, upon the water, in causing it to rise in waves. The agitation of the atmosphere itself is caused in a variety of ways, partly known, partly unknown, into which, however, I here cannot enter; but I have shown already in my treatise on thunderstorms (see THE BUILDER of 20th Sept. 1851), with what force the lowering cloud presses upon and displaces the air beneath it: what then must be the pressure, though unfelt, because so even and so far extended, of the moon upon our atmosphere!

That, apart from the winds and the various currents in the air, there is a regular movement belonging to the whole of the atmosphere is proved by Humboldt. In his "Cosmos" he says:—"One of the main features of the atmosphere is the variation of the pressure of the air between the tropics, a regular, so easily observable, hourly oscillation, a kind of ebb and flow, of the atmosphere, which is not to be ascribed to the attraction of the moon, and which very much varies according to the geographical latitude, the seasons, and the height of the point of observation above the level of the sea." In another place he speaks of "the hourly variations of the atmospheric pressure, which successively take place from east to west, and which in the tropics are so regular."

Whence, then, comes this regular ebb and flow of the tide of the atmosphere? It does not result from the *attraction* of the moon, as Humboldt truly states, nor from any cause operating on the surface of the earth, no more than the tide of the ocean is caused by some operation at its bottom. If the surface of our atmosphere were as tangible to observation as the surface of the sea, I have no manner of doubt but that its tide, in all its features, would resemble the tide of the sea, particularly after what is said by Humboldt of its variation according to place and season. This, and that the tide of both the sea and the air successively take place from east to west, renders it still more probable that the tide of the sea is but the effect of the tide of the air, and that both are caused by the *pressure* of the moon.

My new theory of the tides seems to me the most probably correct one, inasmuch as it requires no forced application, and is simple without any conflicting points, and because it solves the anomalies which cannot be reconciled with the theory hitherto accepted. I do not think, for instance, that it is overstraining my theory if I account for the two opposite points of high water, and the two intervening opposite points of low water, in the following manner:—

To the scientific world it is a well-known fact, that, apart from particular currents, produced by particular causes, the general flow or motion of the air, as well as of the waters of the sea, is from east to west, the same as the tidewaves of the one and the other; and this flow, from east to west, with Galileo and Kepler, I ascribe to the rotation of the earth in the opposite direction from west to east. The moon, sailing, as it were, in the same direction, from west to east, sails against the currents of water and air that flow from east to west. By her pressure upon the atmosphere, the air, as an elastic body, is depressed underneath, and raised before her by her onward course against the contrary current. The first tidewave is thus created in front of the moon, and the air, escaping behind, will rise as much, or nearly so, beyond its ordinary level, as it had been depressed below it, and thus cause the second tidewave to take place. These tidewaves of the air will press upon the water, and cause the tides of the ocean in a corresponding manner; and the pressure of the moon, extending in its effect over at least one-fourth part of the earth, each of the tidewaves will cover the same area, leaving between them, on the opposite side of the earth, another fourth of low water.

As the height of the tides of the sea is influenced by shallows in the sea, by the configuration of the coasts of the mainland, so the variation of the ebb and flow of the air depends much on the chains of mountains it has to pass over, and on the nearness of the moon to, or distance from, such coasts or mountain chains.

I will now try to reconcile a few anomalies of the present, with my new THEORY of the tides.

If the attractive power of the moon is not sufficient to raise a tide at St. Helena, whilst it is said to be the cause of the high tide at "the Land's End," then this anomaly disappears by substituting the *pressure* of the moon for its *attraction*.

A ship on the water will displace as much water as its hulk is immersed in it, and the pressure of the ship on the water below will not be greater than that of the water which it displaced, as the water displaced is equal in weight to the body that has taken its place. But the pressure of the ship will force the water displaced to the sides, and manifest itself in a rise at the shore to which it is driven, supposing the ship to be large, and the water narrow, enough for the purpose.

The moon is nothing else but a ship, to which the ocean is a large river, and gulfs, bays and rivers, are canals: the elastic air readily gives way to the pressure of the moon, and therefore exercises but little, if any, influence on the water underneath, but accumulates in a wave, and pressing upon the water at a distance, makes it rise on the shore. Hence the imperceptible change in the ebb and flow of the water at St. Helena, though the moon be there in the zenith, and the high tide at the Land's End so far away. Hence also *no tides* at any of the *islands* within the torrid zone. Islands, moreover, are to the flow of the water what single hills or solitary mountains are to the motion of the air: neither are of sufficient breadth to offer any perceptible impediment to the course of either.

The anomaly of the tidewave running after the moon, like a carriage drawn by horses round a corner at five minutes' distance, falls likewise to the ground; for, by pressure the moon *does* give a propelling impulse to the water, which will continue to flow and to rise at the shore, though she has passed away.

Respecting the absence of tides in the Baltic and Mediterranean, it is easy to conceive that the continents of Europe and Africa, and their configuration, prevent the tidewaves of the atmosphere having effect upon them, or that these seas are already *beyond* their influence. If, however, as an instance, the Mediterranean were connected with the Southern Ocean, by means of the Red Sea, it would certainly have tides at the place of junction, if not further.

When the moon is in conjunction with, or opposition to, the sun; when she either receives the full reflected light of the earth, or the earth receives that of the moon, her pressure is the greatest, because, in her circuit round the earth, she happens, at that time, to be nearest. It may be, that the pressure of the moon upon our atmosphere, and its effect upon the sea, is the result of her being *attracted by the earth* (which would not alter my theory), and that this attraction, and consequent pressure upon the matter between, is strongest when the one receives the full reflected light of the other, being the time of their greatest approximation.

WM. ADOLPH.

THE "CALORIC" SHIP.

"STEAM SUPERSEDED."

WHILE our American brethren are boasting of their doings in steam engineering, they are trying their best to undo it altogether; and if even half of what we hear of the economy, the safety, and the power of their "caloric engines" be true, steam indeed is doomed to give place to *air*, empowered, however, by the very same force, namely heat, to which we are indebted for all that steam has done or can do. The "caloric engine" is thus, in fact, a misnomer. The steam engine is just as much a "caloric" engine as the "air engine," properly so called by parity of title to that of the "steam engine."

The Ericsson is the name of an "air ship," if we may call it so—rather awkwardly we confess, though, strictly speaking, as correct as "steam-ship" in its own sphere. This air-ship, or "caloric ship," as the Americans call it, is in course of construction at New York, and will be ready for transatlantic navigation by October next. It will be of 2,200 tons burden. Caloric engines are in course of construction for it, but these are not the first of the sort, one of 60 horse power having, it is said, been in successful operation for the last eight months, without repair or accident, at the engine manufactory of Messrs. Hoxy and Delameter, of New York. The cylinders of the Ericsson's engines are no less than 14 feet in diameter, nearly twice the size of those in the Collins steamers.

The *Boston Transcript*, in describing the engine now at work in New York, says:—

"The leading principle of the caloric engine consists in producing motive power by the employment of the expansive force of atmospheric air instead of that of steam: the force being produced by compression of the air in one part of the machine and by its dilatation by the application of heat in another part. [How the compression is produced is not clearly stated: but as heat dilates the air, it is probable that it is cold which in this case is made to compress it, or at least to withdraw the heat, otherwise force would be *expended* in its compression instead of *gained*.] This dilatation, however, is not effected by a continuous application of combustibles, but by a peculiar process of transfer, by which the caloric is made to operate over and over again, viz.—the heat of the air escaping from the working cylinder at each successive stroke of the engine is transferred to the cold compressed air entering the same, so that in fact a continued application of fuel is only necessary in order to make good the losses of heat occasioned by the unavoidable radiation of the heated parts of the machine."

The only fires employed are in small grates, under the working cylinders themselves. There is of course no boiler with furnace, &c., and no chance of explosion. Anthracite forms a cheap and sufficient fire, and the attendance and expense are comparatively trifling, so that passengers' fares are to be on a reduced scale. The only result of neglect would be the stoppage of the engine. No funnel will be required, there being no smoke. A short pipe carries off the products of combustion.

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